

The opinion in support of the decision being entered today was *not* written for publication and is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* YOUNG-HOON KIM, SUN-TAE JUNG,  
and DONG-KYOON HAN

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Appeal 2007-0953  
Application 10/607,466  
Technology Center 2800

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Decided: April 30, 2007

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Before LANCE LEONARD BARRY, JAY P. LUCAS, and  
JOHN A. JEFFERY, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 10-13. Claims 7-9 have been indicated as containing allowable subject matter (Br. 3). We have jurisdiction under 35 U.S.C. § 6(b).

## STATEMENT OF THE CASE

Appellants invented a wavelength division multiplexer/demultiplexer used in a planar lightwave circuit for multiplexing and demultiplexing optical signals. Specifically, the invention comprises an input waveguide for inputting a multiplexed optical signal to an arrayed waveguide grating (AWG), and output waveguides for outputting single-channel optical signals demultiplexed by the AWG. The input waveguide comprises two sub-waveguides: a first sub-waveguide with a parabolic horn shape, and a second sub-waveguide with a progressively decreasing width. Such a structure not only increases bandwidth via mode coupling, but also reduces side-lobe generation by the higher mode optical signal. Both the input waveguide and the output waveguides are disposed on both sides of the substrate centering on the AWG thereby providing a bi-directional multiplexing/demultiplexing capability.<sup>1</sup> Claim 10 is illustrative:

10. A wavelength division multiplexer/demultiplexer for use in a planar lightwave circuit (PLC) having an arrayed waveguide grating including a plurality of optical waveguides, an input waveguide for inputting a multiplexed optical signal to the grating, and output waveguides for outputting single-channel optical signals demultiplexed by the grating, the wavelength division multiplexer/demultiplexer comprising:

an input waveguide having,

a first sub-waveguide, whose width gradually increases in a progressing direction of the optical signal such that, starting at an input of the sub-waveguide and with the gradual increase, tapering of the sub-waveguide is directed inwardly in a concave manner; and

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<sup>1</sup> See generally Specification page 5, line 1 through page 6, line 6; page 9, lines 2-6; page 10, line 15 through page 11, line 14; page 13, line 12 through page 14, line 10.

a second sub-waveguide, continuously joined to the first sub-waveguide, whose width gradually decreases in the progressing direction of the optical signal passing through the first sub-waveguide, wherein the input waveguide, comprising the first and second sub-waveguides, is respectively disposed on both sides of the substrate centering on the arrayed waveguide grating, and the output waveguides arranged in parallel with the input waveguide are respectively disposed on both sides of the substrate centering on the arrayed waveguide grating.

The Examiner relies on the following prior art reference to show unpatentability:

McGreer

US 6,563,988 B2

May 13, 2003

The Examiner's rejection is as follows:

Claims 10-13 are rejected under 35 U.S.C. § 102(b)<sup>2</sup> as being anticipated by McGreer.

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Brief and the Answer<sup>3</sup> for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but chose not to

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<sup>2</sup> Although the Examiner rejected the claims under § 102(b), the cited reference actually qualifies as prior art under §§ 102(a) and (e) -- not § 102(b) -- since the filing date of the present application is Jun. 26, 2003 and the reference's publication date is May 13, 2003. In any event, we consider this procedural error harmless as it does not affect the merits of the anticipation rejection on appeal.

<sup>3</sup> An Appeal Brief was initially filed on Jan. 24, 2005, and an Examiner's Answer was initially filed on Apr. 21, 2005. On Dec. 30, 2005, the Board issued an order indicating, among other things, that the brief was defective. In response, a second Appeal Brief was filed on Jan. 9, 2006 and a second Examiner's Answer filed Apr. 3, 2006. We refer to the second Brief and the second Answer respectively throughout this opinion.

make in the Brief have not been considered and are deemed to be waived.  
*See* 37 C.F.R. § 41.37(c)(1)(vii)(2004).

The Examiner has indicated how the claimed invention is deemed to be fully met by the disclosure of McGreer (Answer 3-4). Regarding independent claim 10, Appellants' argument primarily focuses on the limitation in the last six lines of the claim which, according to Appellants, recites a bidirectional wavelength division multiplexer/demultiplexer arrangement. Appellants argue that McGreer does not disclose such a bi-directional arrangement, namely that "the *input* waveguide...is respectively disposed on *both* sides of the substrate centering on the arrayed waveguide grating, and the *output* waveguides arranged in parallel with the input waveguide are respectively disposed on *both* sides of the substrate centering on the arrayed waveguide grating" (disputed limitations emphasized).

Specifically, Appellants note that McGreer discloses an input side and an output side -- not a bi-directional arrangement where both the input and output waveguides are each disposed on both sides of the substrate centering on the AWG as claimed (Br. 6-8). The Examiner argues that "no specific bi-directional arrangement structure is claimed" and that the structure of Fig. 3A (illustrating an AWG with input and output waveguides) can incorporate the embodiment of Fig. 8 (illustrating transition region) in lieu of the embodiments of Figs. 3B and 3C. The Examiner contends that "[t]hese portions are on both sides of the substrate centering on the AWG and the inputs and outputs are situated in a parallel fashion as claimed" (Answer 5).

For the reasons that follow, we reverse.

## ISSUE

Have Appellants established that the Examiner erred in finding that McGreer discloses a wavelength division multiplexer/demultiplexer where (1) the input waveguide for inputting a multiplexed optical signal to the grating is respectively disposed on both sides of the substrate centering on the AWG, and (2) the output waveguides for outputting single-channel demultiplexed optical signals are respectively disposed on both sides of the substrate centering on the AWG as claimed?

## FINDINGS OF FACT

McGreer discloses an optical wavelength division multiplexing and demultiplexing system that utilizes a planar lightwave circuit known as an AWG router. An exemplary AWG router is shown in Fig. 3A and comprises one or more input channel waveguides 160, an input slab waveguide 170, an AWG 180, and output slab waveguide 190, and one or more output channel waveguides 200. A transition segment 215 provides optical coupling between the slab waveguide and the waveguides on the structure's "input side" and/or "output side" (McGreer, col. 8, ll. 51-67; col. 9, ll. 3-10; col. 3, ll. 4-7; Figs. 3A-3C).

The transition segment can comprise a tapered portion and an extension (McGreer, col. 5, ll. 10-21; col. 9, l. 52 - col. 10, l. 16; Figs. 3B and 3C). In the embodiment of Fig. 8, the taper extension 250 has gradually changing width so that the optical power in the first and third modes is relatively constant as light travels through the extension (McGreer, col. 15, ll. 14-33; Fig. 8). Moreover, the taper extension prevents the first and third modes from coupling together (McGreer, col. 8, ll. 47-50).

## PRINCIPLES OF LAW

Anticipation is established only when a single prior art reference discloses, expressly or under the principles of inherency, each and every element of a claimed invention as well as disclosing structure which is capable of performing the recited functional limitations. *RCA Corp. v. Applied Digital Data Systems, Inc.*, 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984); *W.L. Gore and Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1554, 220 USPQ 303, 313 (Fed. Cir. 1983).

To avoid anticipation, apparatus claims must be distinguished from the prior art in terms of structure rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997).

## ANALYSIS

At the outset, we note that the WDM structure of Fig. 3A of McGreer is structurally similar to the disclosed WDM structure shown in Fig. 4 of the present application. McGreer characterizes the waveguides 160 as “input channel waveguides,” and waveguides 200 are characterized as “output channel waveguides.” Moreover, McGreer refers to the disclosed structure as having an “input side” and an “output side” (McGreer, col. 9, ll. 3-8).

Claim 10, however, requires disposing *both* (1) the input waveguide containing the sub-waveguides, *and* (2) the output waveguides on *both* sides of the substrate centering on the AWG. Certainly, McGreer, in Fig. 3A, discloses multiple waveguides 160 and 200 with transition segments (i.e., sub-waveguides) on both sides of the substrate centering on the AWG as claimed.

This case, therefore, turns on a relatively narrow issue: Notwithstanding their respective labels, can at least some of the “input channel waveguides” 160 in Fig. 3A somehow function as “output waveguides” as claimed? Likewise, can at least some of the “output channel waveguides” 200 somehow function as “input waveguides” as claimed?

If we answer these questions in the affirmative, we must affirm the Examiner’s rejection since we find that McGreer otherwise discloses all of the claimed limitations. However, we are constrained to find that the record before us simply does not reasonably support such an interpretation.

We note that the preamble of claim 10 recites the functionality of the input and output waveguides respectively. That is, the input waveguide is “for inputting a multiplexed optical signal to the grating” and the output waveguide is “for outputting single-channel optical signals demultiplexed by the grating.” While such limitations can be considered mere intended use of the respective waveguide structures, to anticipate the claim, McGreer’s waveguides 160 and 200 must nevertheless be capable of performing both of the recited functions. *See Schreiber*, 128 F.3d at 1477-78, 44 USPQ2d at 1431-32.

McGreer does state that the disclosed apparatus can be used to multiplex or demultiplex signals (McGreer, col. 9, ll. 9-10). But McGreer does not state that the “input side” or the “output side” can be either side of the substrate. Rather, the most reasonable reading of McGreer is that a multiplexed signal can be inputted to the “input side” and demultiplexed single-channel optical signals can be obtained on the “output side.”

Likewise, demultiplexed single-channel optical signals can be inputted to the “input side” and a multiplexed optical signal can be obtained on the “output side.”

But there is no express or inherent disclosure in McGreer that the “output side” can also function as an “input side” with respect to at least some of the output channel waveguides 200 such that the “output side” is capable of outputting *and* inputting *both* multiplexed *and* demultiplexed optical signals. Likewise, McGreer is silent regarding the ability of the “input side” to function as an “output side” with respect to at least some of the input channel waveguides 160 such that the “input side” is capable of outputting *and* inputting *both* multiplexed *and* demultiplexed signals.

At best, McGreer discloses a *uni-directional* multiplexing and demultiplexing capability -- not a *bi-directional* capability. We realize that the term “bi-directional” appears nowhere in claim 10. But the limitations recited in the last six lines of claim 10 setting forth the relative locations of the input and output waveguides, along with the recited functionality of those waveguides recited in the preamble, effectively recite a bi-directional capability.

We reach this conclusion emphasizing that we are constrained by the record before us. Although McGreer is structurally similar to the claimed invention, we find no evidence on this record that establishes a bi-directional multiplexing/demultiplexing capability for the structure of McGreer. To conclude otherwise without supporting evidence would require us to resort to speculation. That we will not do.

We cannot say that no prior art exists that would establish that the structure of McGreer is capable of performing bi-directional multiplexing



and demultiplexing, or that such functionality in planar lightwave circuits is well known in the art. We can say, however, that no such prior art exists on this record.

For the foregoing reasons, we will not sustain the Examiner's rejection of independent claim 10. Likewise, we will not sustain claims 11-13 which depend therefrom.

### CONCLUSION OF LAW

Appellants have established that the Examiner erred in finding that McGreer discloses a wavelength division multiplexer/demultiplexer where (1) the input waveguide for inputting a multiplexed optical signal to the grating is respectively disposed on both sides of the substrate centering on the AWG, and (2) the output waveguides for outputting single-channel demultiplexed optical signals are respectively disposed on both sides of the substrate centering on the AWG as claimed.

### DECISION

We have not sustained the Examiner's rejection with respect to all claims on appeal. Therefore, the Examiner's decision rejecting claims 10-13 is reversed.

### REVERSED

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